

### INTRODUCTION

On June 26, 1996, the Office of the Comptroller of the Currency, Board of Governors of the Federal Reserve System, and the FDIC issued the Joint Agency Policy Statement on Interest Rate Risk (Policy Statement). The Policy Statement provides guidance to bankers on sound interest rate risk management practices.

FDIC examination procedures follow a multi-level framework that incorporates the Policy Statement's guidelines and efficiently allocates examination resources. Examination scope will vary depending upon each bank's interest rate risk management and exposure. The procedures guide examiners towards a qualitative interest rate risk assessment, rather than a uniform supervisory measurement.

### I. INTEREST RATE RISK

Interest rate risk (IRR) is the exposure of a bank's current or future earnings and capital to interest rate changes. Interest rate fluctuations affect earnings by changing net interest income and other interest-sensitive income and expense levels. Interest rate changes affect capital by altering banks' economic value of equity (EVE).

EVE represents the net present value of all asset, liability, and off-balance sheet instrument cash flows. Interest rate movements will change the present values of those cash flows. EVE captures the long-term, expected change to earnings that will result from an interest rate movement.

Banks are financial intermediaries, and IRR is intrinsic to banking. However, excessive IRR can threaten banks' earnings, capital, liquidity, and solvency. IRR has many components, including repricing risk, basis risk, yield curve risk, option risk, and price risk.

**Repricing risk** results from timing differences between coupon changes or cash flows from assets, liabilities, and off-balance sheet instruments. For example, long-term fixed rate securities funded by short-term or variable rate deposits may create repricing risk. If interest rates change, then the deposit funding costs will change more quickly than the securities' yield.

**Basis risk** results from weak correlation between coupon rate changes for assets, liabilities, and off-balance sheet instruments. For example, LIBOR-based deposit rates may change by 50 basis points,

while Prime-based loan rates may only change by 25 basis points during the same time period.

**Yield curve risk** results from changing rate relationships between different maturities for the same index. For example, a 30-year Treasury bond's yield may change by 200 basis points, but a three-year Treasury note's yield may change by only 50 basis points during the same time period.

**Option risk** results when a financial instrument's cash flow timing or amount can change as a result of market interest rate changes. This can adversely affect earnings or EVE by reducing asset yields, increasing funding costs, or reducing the net present value of all expected cash flows.

For example, assume that a bank purchased a callable bond, issued when market interest rates were 10 percent, that pays a 10 percent coupon and matures in 30 years. If market rates decline to eight percent, the bond's issuer will call the bond (new debt will be less costly).

At call, the issuer effectively repurchases the bond from the bank. As a result, the bank will not receive the cash flows that it originally expected (10 percent for 30 years). Instead, the bank must now invest that principal at the new, lower market rate.

In addition, many loan and deposit products contain option risk. For example, borrowers may prepay part or all of their loan principal at any time. Also, savings account depositors may withdraw their funds at any time.

**Price risk** results from changes in the value of marked-to-market financial instruments that occur when interest rates change.

For example, trading portfolios, held-for-sale loan portfolios, and mortgage servicing assets contain price risk. When interest rates decrease, mortgage servicing asset values generally decrease. Since those assets are marked-to-market, any value loss must be reflected in current earnings.

### II. IRR MANAGEMENT

The board of directors (board) must ensure that management effectively identifies, measures, monitors, and controls IRR. The policies, procedures, and systems used to achieve those goals comprise the

IRR management program.

Although many methodologies effectively guide IRR management, all programs should address:

- Board and senior management oversight
- Strategies, risk limits, and controls
- Risk identification and measurement
- Monitoring and reporting
- Independent review

The bank's complexity and risk profile should determine its IRR management program's formality and sophistication. Banks that do not employ complex strategies, maintain basic balance sheet structures, and exhibit low IRR may rely on less intricate programs. However, all procedures should be clearly documented and senior management should actively supervise daily operations.

More complex banks will likely need more formal, detailed IRR management programs. In such cases, management should establish specific controls and produce cogent analysis that addresses all major risk exposures. At those banks, internal controls should include an independent review process for IRR analysis and requirements for reasonable separation of duties.

### Board Oversight

Effective board oversight is the cornerstone of sound risk management. The board must understand the bank's risk exposures and how those risks affect current operations and strategic plans. The board has three primary IRR responsibilities. The board should:

- Establish strategy and acceptable risk tolerance levels, including policies, risk limits, and management authority and responsibility.
- Monitor IRR to prevent excessive risk exposure.
- Provide adequate IRR management resources.

### Senior Management Oversight

Senior management's responsibilities include both long-range and daily IRR management. Senior

management should:

- Implement procedures that translate the board's policies into clear operating standards.
- Maintain a measurement system that identifies, measures, and monitors IRR.
- Establish effective internal IRR controls.

### Strategies, Risk Limits, and Controls

Effective board and senior management oversight requires reasonable strategies, prudent risk limits, and clear internal controls. Internal controls should address management authority and responsibility, permissible activities, and staffing needs.

**Strategies** should address all relevant IRR factors, such as capital, earnings, balance sheet structure, economic and interest rate forecasts, and long-term business plans. Management should develop strategies that address the board's policies and risk limits. Those strategies may incorporate off-balance sheet activities, balance sheet structure changes, product pricing guidelines, or other management tactics.

A strategy's detail and formality should depend upon the bank's size, complexity, and management expertise. All related activities, such as lending, deposits, and investments, should be coordinated. Generally, the management committee responsible for IRR should include a representative from each major product area.

**Risk limits** should establish the board's IRR tolerance by restricting earnings and capital volatility for given interest rate movements. The board should document and approve risk limits that guide management's activities and do not create safety and soundness concerns.

Limits should reflect the bank's complexity and capital strength. Further, they should relate directly to the internal measurement system's methodology. In addition, limits should specifically address IRR effects on reported earnings and capital.

Management should maintain IRR exposure within the established limits. Internal controls should ensure that when exposures exceed the risk limits management promptly reviews the exception and reports it to the

board. The board should review all policy and risk limit exceptions. However, effective limits should provide management with the flexibility to respond to changing economic conditions.

Earnings-based risk limits may include volatility restrictions on:

- Net interest margin
- Net operating income
- Net income

Capital-based risk limits may include volatility restrictions on:

- EVE
- Regulatory capital

**Authority and responsibility** should clearly delineate management's duty to identify, measure, monitor, and control IRR.

**Permissible activities** should identify the strategies and instruments that management can use to control IRR. Policies should specifically describe the instruments and activities that the board authorizes and those that management may not use without prior board approval.

**Staffing** resources should permit effective IRR management, including:

- Sufficient staff to operate measurement systems, including back-up personnel.
- Appropriate analytic expertise.
- Adequate training and staff development.

### Risk Identification and Measurement

Prudent risk management demands accurate, timely IRR quantification. Although many measurement methods exist, an effective system must clearly identify, quantify, and report the bank's risks.

When evaluating IRR, well-managed banks should consider both earnings and economic approaches. Reduced earnings, or losses, can harm capital, liquidity, and even marketplace perception. EVE measurements provide longer-term earnings and capital analysis.

The Level Three Examination Procedures subsection details measurement system methodologies and examination procedures.

### Risk Monitoring and Reporting

Banks should maintain systems that concisely report IRR. At least quarterly, senior management and the board should review those reports. However, banks that engage in complex activities or display significant IRR should assess IRR more frequently. IRR reports should contain sufficient detail to permit management and the board to:

- Identify IRR levels.
- Evaluate key assumptions, including interest rate forecasts, deposit behavior, and loan prepayments.
- Verify compliance with policies and risk limits.

### Independent Review

The board should subject its IRR management program to periodic independent review. Independent review may encompass external audit, internal audit, or simply evaluation by personnel independent of IRR management. Independent review considerations should include:

- Adherence to policies and risk limits.
- The internal measurement system's adequacy and accuracy.
- Personnel resources and expertise.

The independent review program's scope and formality should correspond to the bank's size, complexity, and IRR profile. Larger, more complex banks may use internal or external auditors. Banks that operate complex IRR measurement systems should subject those systems to independent testing and validation. Smaller, less complex banks may rely upon less formal independent review. Regardless, independent review findings should be reported directly to the board at least annually.

## III. IRR MEASUREMENT METHODS

### Overview

IRR measurement systems range from simplistic to extremely complex. Despite that variety, all systems require verifiable account data, rely heavily on assumptions, and lose precision when analyzing complex instruments or volatile markets. Most important, measurement systems are only a forecasting tool and can not flawlessly predict cash flows, earnings, or capital.

### Measurement System Approaches

IRR measurement systems use an earnings approach, an economic value approach, or a blend of those two approaches. Each approach provides a different, but not necessarily contradictory, view.

**The earnings approach** focuses on risks to reported earnings, usually over a shorter-term time horizon. Typically, earnings systems estimate risk for up to two years. In addition, estimating future earnings permits regulatory capital forecasts.

The earnings approach traditionally focus on net interest income. However, many systems now incorporate components that measure the price risk from instruments accounted for at market value or lower-of-cost or market value. Those systems estimate gains and losses from assets that include loans held for sale, trading portfolios, and mortgage servicing rights.

**The economic value approach** estimates the bank's EVE for forecasted interest rate changes. This method assumes that all financial instruments will be held until final payout or maturity. The economic value approach might provide a broader scope than the earnings approach, since it captures all anticipated cash flows.

The economic value approach best suits banks that mark most instruments to market. At banks that value most instruments at historical cost, economic value measurements can also effectively estimate IRR. However, in those banks, EVE changes might be recognized over a longer time frame (through reported earnings).

As a result, banks often blend the two approaches. Management may use an earnings approach to evaluate short-term performance and an economic approach to monitor the bank's long-term viability. Despite using different methodologies, the two approaches should not report conflicting IRR exposures.

### Gap Analysis

Gap systems use an accrual approach to identify risk to net interest income. Typically, gap systems identify maturity and repricing mismatches between assets, liabilities, and off-balance sheet instruments. Gap schedules segregate rate-sensitive assets, rate-sensitive liabilities, and off-balance sheet instruments according to their repricing characteristics. Then, the analysis summarizes the repricing mismatches for each defined time horizon. Additional calculations convert that mismatch into risk to net interest income. Gap analysis may identify periodic, cumulative, or average mismatches.

The gap ratio is calculated with the following formula:

$$\frac{\text{Rate-sensitive Assets less Rate-sensitive Liabilities}}{\text{Average Earning Assets}}$$

Occasionally, average assets or total assets may be used in place of average earning assets. However, those denominators can underestimate IRR.

The gap ratio should also be expressed as the percentage risk to net interest income. Multiply the gap ratio by the assumed rate change. The result estimates the change to the net interest margin.

For example, a bank has a 15% one-year average gap. If rates decline 2%, then the net interest margin will decline by 30 basis points ( $15\% \times .02$ ). This estimate assumes a static balance sheet and an immediate and sustained interest rate shift.

Gap analysis has several advantages. It:

- Does not require sophisticated technology.
- May be relatively simple to develop and use.
- Can provide clear, easily interpreted results.

However, gap's weaknesses often overshadow its strengths, particularly for larger, more complex banks. For example, gap analysis:

- Generally captures only repricing risk.
- May not identify repricing risk within the stated time horizons.
- Does not measure EVE.

- Generally can not analyze complex instruments.

Some gap systems attempt to capture basis, yield curve, and option risk. Multiple schedules (called dynamic or scenario gap analysis) can show effects from nonparallel yield curve shifts. Additionally, sensitivity factors may be applied to account categories. Those factors assume that the coupon rate for an account will change by a certain percentage for a given change in a market index. That market index is designated as the driver rate (sophisticated systems may use multiple driver rates). Those sensitivity percentages, also called beta factors, may dramatically change the results.

Banks often use sensitivity factors to refine non-maturity deposit gap analysis. For example, management may determine that its MMDA cost of funds will increase 25 basis points whenever the six-month Treasury bill rate increases one percent. Thus, management might consider only 25% of MMDA balances rate-sensitive for gap analysis. Management may expand its analysis by preparing gap schedules that assume different market rate movements and changing customer behaviors.

Gap analysis may provide sufficient IRR measurements for some banks. However, gap analysis may be ineffective for banks with complex structures or activities.

### Duration Analysis

**Macauley duration**, duration's simplest form, calculates the weighted average term to maturity of a security's cash flows. Duration always:

- Declines as time elapses.
- Equals less than maturity for instruments with payments prior to maturity.
- Equals maturity for zero-coupon instruments.
- Is lower for instruments with higher coupons.
- Is lower for amortizing instruments.

**Modified duration**, calculated from Macauley duration, estimates price sensitivity for small interest rate changes. An instrument's duration represents its percentage price change given an assumed parallel yield curve shift. Thus, it serves as proxy IRR

measure.

### Example:

Instrument: 3 year bond, 10% annual coupon, 10% annual yield.

Macauley Duration Calculation				
3 year bond, 10% coupon, 10% yield				
Year	Payment	PV $\times$	T	PV $\times$ T
1	\$ 100	90.9	1	\$ 90.9
2	100	82.6	2	165.2
3	1,100	826.4	3	2,479.3
		1,000.0		2,735.4
T=Time period payment is received				
Macauley Duration = $\frac{2,735.4}{1,000} = 2.74$ years				

Next, calculate modified duration. First, assume that interest rates increase one percent (an instantaneous 100 basis point parallel yield curve increase). Then, divide the bond's Macauley duration by one plus its yield. As shown below, price decreases by approximately 2.5 percent.

$$\begin{aligned} \text{Modified Duration} &= \frac{\text{Macauley Duration}}{(1 + \text{Yield})} \\ &= \frac{2.74}{1.10} = -2.49\% \end{aligned}$$

However, modified duration assumes that interest rate shifts will not change an instrument's cash flows. As a result, it does not accurately estimate price sensitivity for instruments with embedded options (for example, callable bonds or mortgages). Banks with significant option risk should not rely upon modified duration to measure IRR.

**Effective duration** estimates price sensitivity more accurately than modified duration for instruments with embedded options. However, effective duration is calculated using valuation models that contain option pricing components. First, management determines the instrument's current value. Next, the valuation model assumes an interest rate change (usually 100 basis points) and estimates the instrument's value. The percentage change between the current and forecasted values represents the instrument's effective duration.

All duration measures assume a linear price/yield relationship. However, that relationship actually is curvilinear. That is, beyond 100 basis point interest rate changes, the mathematical relationship between price and yield does not remain constant. Therefore, duration may only accurately estimate price sensitivity for rather small (up to 100 basis point) interest rate changes.

**Convexity** describes the nonlinear price/yield relationship. Option-free instruments display positive convexity. When rates decline, a positively convex instrument's price increases at an increasing rate. When rates rise, a positively convex instrument's price decreases at a decreasing rate.

Instruments that contain embedded options demonstrate negative convexity. When rates decline, a negatively convex instrument's price increases at a decreasing rate. When rates rise, a negatively convex instrument's price declines at an increasing rate.

Convexity-adjusted duration should be used to more accurately estimate price sensitivity for larger interest rate changes (over 100 basis points).

EVE may be calculated using duration. For example, assume that a bank has rate sensitive assets (RSA) valued at \$10,000 with a duration of 4 years and rate sensitive liabilities (RSL) valued at \$9,000 with a duration of 4 years. For a 1% interest rate change, the following will occur:

- RSA value changes \$400 ( $\$10,000 \times 4 \times 1\%$ ).
- RSL value changes \$360 ( $\$9,000 \times 4 \times 1\%$ ).
- EVE changes by \$40 ( $\$400 - \$360$ ).

Despite maintaining matched duration percentages for assets and liabilities, the bank's EVE changes by four percent when rates change by one percent. This results from the dollar duration gap created by the difference between RSA and RSL volume. Thus, banks that use duration to manage IRR should maintain asset and liability durations based on dollar value changes, not raw duration.

Duration analysis provides significant advantages over gap analysis. Duration analysis yields a single IRR number and considers all expected cash flows. Thus, duration generates a more comprehensive IRR measurement. Duration analysis can provide more accuracy than maturity gap analysis for measuring and

managing IRR.

Despite those advantages, duration analysis contains weaknesses that limit its practical applications. Accurate duration calculations demand sophisticated accounting and information systems. Further, duration accurately measures value changes for only relatively small interest rate fluctuations. Therefore, banks must frequently update duration measures during volatile interest rate environments.

### Simulation Analysis

Simulation analysis determines the effect of interest rate changes on short-term net interest income, net income, and, in some cases, EVE. Simulation models generate results for a range of probable interest rate environments and risk exposures.

Banks may vary simulation rate scenarios based on factors such as pricing strategies, balance sheet composition, and hedging activities. Simulation may also measure risk presented by non-parallel yield curve shifts. Any simulation system's accuracy, though, depends on the assumptions and data used. Inaccurate data or unreasonable assumptions render simulation results meaningless. Simulation models are often not "user friendly" and may require more data and expertise than other IRR measurement systems.

Simulation systems vary greatly, both in methodology and sophistication. Some systems focus on short-term earnings, some concentrate on EVE, and others blend those views. Despite those differences, most simulation systems share two characteristics: They require advanced information systems and technical expertise.

## IV. EXAMINATION GOALS

The three primary goals require that examiners:

- Evaluate the IRR management program.
- Determine if IRR presents safety and soundness concerns and recommend corrective action when warranted.

The IRR examination procedures accomplish those goals and:

- Limit examination scrutiny and resources for banks that demonstrate financial strength, effective management, and minimal IRR.
- Focus examination resources on banks that demonstrate significant IRR.
- Expedite offsite analysis.

## V. PROCEDURAL OVERVIEW

The four-level approach achieves the examination's goals and effectively allocates examination resources. The IRR Decision Chart, shown on page 5.2-19, summarizes the process. *The examination procedure levels do not indicate IRR severity.* Rather, the levels define the examination's scope.

**Level One Examination Procedures** apply to all banks and identify those with minimal IRR, strong financial condition, and satisfactory management. At those banks, streamlined examination procedures may be used. At Level One, examiners shall evaluate the IRR management program and objective financial criteria.

**Level Two Examination Procedures** apply to banks that do not meet certain Level One criteria. Examiners shall perform financial analysis, review the internal measurement system's results, and assess strategic initiatives. However, examiners will not conduct a detailed review of the IRR measurement system.

**Level Three Examination Procedures** apply to banks that exhibit significant IRR or unsatisfactory IRR management. Examiners shall comprehensively evaluate the IRR measurement system. If the system produces reliable results, then the examination's IRR assessment shall rely on those results.

**Level Four Examination Procedures** apply to banks that exhibit significant IRR or unsatisfactory IRR management, and that do not use a reliable measurement system. Examiners will identify the measurement system's deficiencies, detail any safety and soundness concerns, and recommend corrective action.

## EXAMINER JUDGEMENT

The examination procedures serve only as a guide.

Apply discretion and consider expanding or truncating procedures when warranted.

For example, banks holding off-balance sheet derivatives will generally be subject to Level Three procedures. However, a bank may only hold one interest rate swap that serves a specific purpose and creates minimal risk. If the bank demonstrates effective IRR management and financial strength, then Level One procedures may suffice.

Examiners may also expand procedures outside the established framework. For example, the examination's earnings review may raise concerns that warrant expanding the IRR examination, even though the bank meets all Level One criteria.

Examiners must draw upon experience and knowledge to evaluate each situation, and should fully support decisions to expand or truncate the procedures within the examination workpapers.

## Level One Examination Procedures

***Level One Procedures apply to all banks.***

### IRR Management Program Assessment

Evaluate the bank's policies, controls, measurement system reports, and objective criteria.

**IRR policies** should:

- Assign authority and responsibility for establishing and maintaining an effective IRR management program.
- Require board review of policy exceptions.
- Establish reasonable IRR limits relative to earnings and capital.
- Require an adequate and accurate IRR measurement system.
- Require timely reports that detail risks, measures, and compliance with risk limits.

**Board and management IRR reports** should:

- Measure IRR's effect on earnings and capital.

- Verify compliance with risk limits.
- Provide timely analysis.

**Independent review** should:

- Verify compliance with risk limits.
- Review the data, assumptions, and forecasts input into the measurement system.
- Evaluate past system measurements against actual results.

**IRR staffing** should:

- Demonstrate technical expertise consistent with the bank's complexity, risk profile, and measurement system.
- Receive sufficient resources and training.
- Maintain independence between the IRR management and review functions.

## Objective Criteria Assessment

The Level One objective assessment applies standardize criteria to identify conditions that may indicate potential IRR. Banks that meet the criteria generally exhibit less complexity and IRR. Banks that do not meet the criteria may have a complex structure or material IRR. As a result, additional examination procedures should be considered for those banks. The chart shown on page 5.2-9 fully details the Level One objective criteria.

## Level One Examination Conclusions

If the bank has satisfactory management, acceptable financial strength, and minimal IRR, then conclude the IRR review. However, consider expanding the examination's scope if the bank's management, financial condition, or IRR demonstrates weakness.

Level One Examination Objective Criteria Assessment		
Category	Objective Criteria	Assessment



Are appropriate policies, controls, and procedures in place?	Last examination Uniform Bank Rating (UBR) management component rating and composite rating of 1 or 2.  No material IRR criticisms at the last examination.	Unfavorable composite rating, management rating, or material criticism regarding the IRR program suggests additional risk. Consider Level 3 Examination Procedures.																					
Are High Risk Mortgage Securities and other potentially volatile assets below thresholds?	High-risk mortgage securities and mortgage servicing assets each comprise less than 50% of tier 1 capital.  Sum of high-risk mortgage securities, mortgage servicing assets, and structured notes comprise less than 100% of tier 1 capital.	Material positions in such potentially volatile instruments suggests increased IRR and presents IRR measurement challenges. Consider Level 3 Examination Procedures.																					
Are off-balance sheet derivatives present?	No off-balance sheet derivatives.	Derivatives may reduce other risks, but they also require enhanced IRR management. Consider Level 3 Examination Procedures.																					
Is the asset structure short-term?	100% of assets that mature or reprice in 5 years or more equals less than 30% of total assets.	Long-term asset structures suggest higher IRR. Consider Level 2 Examination Procedures.																					
Do capital and earnings levels reasonably mitigate IRR concerns?	Capital and earnings meet the following criteria: <table><tr><td>Tier 1</td><td>3-year Avg. Return</td><td></td></tr><tr><td><u>Leverage Capital</u></td><td><u>On Average Assets</u></td><td>-</td></tr><tr><td>6.00% to 6.99%</td><td>&amp; 1.50% or greater</td><td></td></tr><tr><td>7.00% to 7.99%</td><td>&amp; 1.25% or greater</td><td></td></tr><tr><td>8.00% to 8.99%</td><td>&amp; 1.00% or greater</td><td></td></tr><tr><td>9.00% to 9.99%</td><td>&amp; 0.75% or greater</td><td></td></tr><tr><td>10.00% or more</td><td>&amp; 0.50% or greater</td><td></td></tr></table>	Tier 1	3-year Avg. Return		<u>Leverage Capital</u>	<u>On Average Assets</u>	-	6.00% to 6.99%	& 1.50% or greater		7.00% to 7.99%	& 1.25% or greater		8.00% to 8.99%	& 1.00% or greater		9.00% to 9.99%	& 0.75% or greater		10.00% or more	& 0.50% or greater		The capital and earnings thresholds provide flexibility to accommodate moderate IRR. Banks that do not meet the criteria have limited capacity to absorb IRR through earnings and capital. Consider Level 2 Examination Procedures.
Tier 1	3-year Avg. Return																						
<u>Leverage Capital</u>	<u>On Average Assets</u>	-																					
6.00% to 6.99%	& 1.50% or greater																						
7.00% to 7.99%	& 1.25% or greater																						
8.00% to 8.99%	& 1.00% or greater																						
9.00% to 9.99%	& 0.75% or greater																						
10.00% or more	& 0.50% or greater																						

## Level Two Examination Procedures

Use Level Two Examination Procedures for banks that do not meet the Level One long-term asset or earnings and capital thresholds. Level Two Procedures identify risk exposures or verify significant risk. The procedures focus on:

- Net interest margin (NIM) volatility.
- Securities appreciation or depreciation.
- Balance sheet composition.
- Internal measurement system results.
- Management's strategic initiatives.

For Level Two procedures, examiners shall review the Interest Rate Risk Standard Analysis (IRRSA), the internal measurement system results, and management's strategic plans. Notably, examiners should not evaluate the internal measurement system's methodology or accuracy during a Level Two examination.

## NIM Volatility

Since net interest income is usually the largest component of pre-tax operating income, small net interest income changes may generate significant earnings fluctuations. Banks that demonstrate material NIM volatility, either quarterly or annually, may have significant IRR. However, NIM volatility may result from factors not related to IRR. Carefully evaluate historical data and determine the sources for the volatility.

Compare NIM volatility to market interest rate fluctuations over a reasonable time period. IRRSA provides the data needed for that analysis. Focus the analysis on periods of significant market rate volatility. NIM volatility approaching or exceeding market rate volatility may indicate significant IRR.

For example, NIM volatility in a rising rate environment,

despite a stable asset and funding base, suggests repricing risk exposure. Conversely, NIM volatility during a stable rate environment suggests that IRR may not have caused the fluctuations. Potential causes include accrual adjustments, reporting errors, or balance sheet structural changes.

Determine if earnings can absorb reductions in net interest income that may result from interest rate volatility. IRR should not threaten earnings viability or erode capital. Although a bank with a high NIM can generally accept higher IRR, it should also have strong pre-tax net operating income and capital. High overhead, or other factors, may magnify NIM volatility effects on earnings and capital.

In addition, evaluate management's efforts to minimize NIM volatility's effects on earnings and capital. Management may bolster noninterest income or reduce overhead to offset NIM fluctuations, particularly in banks with significant fee-related businesses (for example, trust or nondeposit investment sales). Management's demonstrated ability to consistently moderate NIM volatility may ameliorate IRR concerns.

### Securities Appreciation or Depreciation

Securities portfolio market values are highly sensitive to market interest rates. High current depreciation (relative to capital) may reduce management's ability to absorb future IRR, and may diminish liquidity, earnings, and capital if that depreciation must be recognized. Depreciation or appreciation volatility during periods of fluctuating interest rates implies IRR within the portfolio.

Review IRRSA (and the IRRSA User Guide) and analyze securities depreciation and appreciation. When volatility or significant depreciation or appreciation occurs, evaluate bank portfolio reports to determine IRR sources. Remember that high appreciation may also indicate significant IRR.

However, market value fluctuations may be offset by other factors, including:

- Stable, low cost funding
- Effective hedging of volatile securities
- Offsetting realized securities gains

### Balance Sheet Composition

Evaluate balance sheet composition and structural trends. Identify conditions that may create material IRR, or trends that may change the bank's IRR profile. Analyze IRRSA (and the IRRSA User Guide) and determine if significant IRR exists.

For example, increased investment in long-term assets funded by short-term debt may introduce added repricing risk.

When significant structural changes have occurred, de-emphasize historical analysis and focus on current and forecasted balance sheet composition.

### Internal Measurement System Results

Review the internal measurement system results. Do not conduct a detailed internal measurement system assessment.

### Strategic Initiatives

Evaluate management's strategic plan and any other relevant examination information. If management plans new activities, significant balance sheet structural changes, or hedging activity, additional IRR may result. The IRR management program should be able to identify, measure, monitor, and control any new risk exposures.

### Level Two Examination Conclusions

If NIM volatility, securities depreciation level or trend, balance sheet structure, strategic initiatives, internal IRR measurements, or other factors indicate significant IRR, then consider implementing Level Three Examination Procedures.

### Level Three Examination Procedures

Level Three Examination Procedures apply to banks that exhibit significant IRR or unsatisfactory IRR management.

Comprehensively evaluate the internal measurement system's reliability. Refer to the IRR Measurement System Review subsection for additional guidance. Regional Capital Markets Specialists (or designees) may also provide additional support and guidance. If the system's design, methodology, or assumptions

generate unreliable results, work with management to refine the system during the examination.

### Level Three Examination Conclusions

When management produces reliable IRR measurements, use those results to assess the bank's exposure. However, those measurements comprise only one element of a complete qualitative IRR assessment. That assessment should consider the bank's IRR management, controls, strategic plans, financial condition, and IRR measurements. If IRR threatens earnings or capital viability, then address the potential safety and soundness concerns and consider appropriate recommendations.

If the bank's measurement system does not produce reliable IRR results, then implement Level Four procedures. If the bank does not use an measurement system, then implement Level Four procedures.

### Level Four Examination Procedures

Implement Level Four procedures only after conducting Level Three procedures. Apply Level Four procedures when a bank exhibits significant risk or unsatisfactory IRR management, and does not employ a reliable IRR measurement system.

Level Four procedures focus on potential safety and soundness concerns that result from the bank's risk exposure, internal measurement system deficiencies, and management weaknesses.

Should management fail to remedy all deficiencies, corrective action may result. Examination conclusions and workpapers should clearly support any corrective action recommendations.

Fully document the internal measurement system's deficiencies, including:

- Design flaws
- Quantitative errors
- Data inaccuracies
- Unreasonable assumptions
- Reporting weaknesses

Recommend actions that management should take to correct those deficiencies.

Assess the potential safety and soundness concerns

that result from the bank's IRR exposure. Safety and soundness concerns arise when IRR threatens earnings viability or capital adequacy. Analyze the IRR exposure by evaluating all available data, including:

- IRRSA
- UBPR data
- Other examination information
- Any accurate internal system data

Seek management's commitment to remedy the IRR exposure, management, and control deficiencies. Examination conclusions should clearly detail management's responses to all recommendations.

Recommend an accelerated IRR examination schedule if management's efforts to rectify deficiencies should be verified before the next regular safety and soundness examination.

For example, assume that a bank uses off-balance sheet derivatives as hedging instruments, but its measurement system can not measure hedge effectiveness or the related risks. Examination conclusions identify those risks and detail the measurement system's deficiencies. Supervisory recommendations include measurement system improvements that will enable the system to reliably quantify hedge effectiveness and overall IRR.

Since the hedging activity materially affects earnings and capital, the examiner recommends an accelerated IRR examination schedule. That targeted review should focus on management's efforts to correct the management, control, and measurement system weaknesses noted at the previous examination. If IRR management does not materially improve, then formal or informal corrective action may be warranted.

## VI. IRR Measurement System Review

Determine if the bank's IRR measurement system enables management to measure and monitor IRR. Focus on:

- Identifying IRR exposures.
- Determining the system's capabilities.
- Evaluating the objective data.
- Assessing the key assumptions.

- Reviewing the system's results.
- Verifying reasonable system validation.

### Identify IRR Exposures

The IRR measurement system must capture and measure all material risk exposures. Therefore, any measurement system review should begin by identifying the bank's exposures. Use all available information, including:

- IRRSA
- Balance sheet and account data
- Bank IRR analysis
- Strategic and business plans
- Product pricing guidelines
- Hedging or derivative activity
- All examination findings

**Long-term, fixed-rate assets** may create repricing risk in banks that have traditional, shorter-term funding structures.

**Embedded options** within assets, liabilities, and off-balance sheet derivatives create significant risks. Embedded options include any feature that can alter an instrument's cash flows when interest rates change. Many instruments contain various embedded options, including:

- Callable bonds
- Mortgage-backed securities
- Structured notes
- Mortgage loans
- Nonmaturity deposits
- Derivatives

For example, mortgage loans contain prepayment options. Borrowers may prepay loan principal at any time, which alters the mortgages' cash flows and creates material IRR considerations.

**Funding sources** may create repricing risk, basis risk, yield curve risk, or option risk. Evaluate the fundamental relationship between funding sources and asset structure. Potentially volatile or market-based funding sources may increase IRR, especially when matched to a longer-term asset portfolio.

For example, fixed-rate mortgages funded by purchased federal funds create repricing risk. Funding

costs may increase substantially, while asset yields remain fixed.

**Nonmaturity deposits** may mitigate some IRR. Nonmaturity deposit funding costs generally demonstrate less volatility than market interest rates. As a result, high nonmaturity deposit volumes may actually reduce repricing risk and moderate overall IRR. However, significant interest rate or economic changes can rapidly alter customers' nonmaturity deposit behavior.

Nonmaturity deposit assumptions are crucial components of any IRR measurement system. Carefully review management's nonmaturity deposit assumptions. Those assumptions should be reasonable and well supported. In addition, IRRSA provides nonmaturity deposit interest rate sensitivity analysis.

**Off-balance sheet derivatives** may introduce complex IRR exposures. Depending on the specific instrument, derivatives may create repricing, basis, yield curve, option, or price risk.

**Mortgage banking** operations create price risk within the loan pipeline, held-for-sale portfolio, and mortgage servicing rights portfolio. Interest rate changes affect not only current values, but also determine future business volume.

**Fee income** businesses may contain IRR, particularly trust, credit card servicing, and non-deposit investment sales. Changing interest rates may dramatically affect such activities.

**Product pricing strategies** may introduce IRR, particularly basis risk or yield curve risk. If funding sources and assets are linked to different market indices, then basis risk exists. If funding sources and assets are linked to indices with different maturities, then yield curve risk exists.

Management should clearly identify and document the bank's material IRR exposures. That analysis should address how the IRR management program measures, monitors, and controls those risks.

### Determine System Capabilities

The IRR measurement system must capture and reliably estimate the bank's material risk exposures. Therefore, the system should consider all significant

risk factors. For example, if the bank holds material mortgage loan or mortgage-backed security assets, then the system should incorporate prepayment projections.

Management should fully understand the measurement system, including its:

- Capabilities
- Limitations
- Quantitative methodology
- Assumptions

**System documentation** should provide complete information regarding the above factors. Both models purchased from vendors and internally developed systems should be supported by complete documentation. Management should read and retain all system documentation.

In addition, vendor systems often require additional components (for example, an option pricing module) or periodic updates. Without the needed components, the system may not calculate accurate results. Verify that the system contains the components and updates needed to generate accurate measurements.

Discuss the system's capabilities, limitations, and assumptions with management. If the system ignores significant risks or relies on incorrect methodology, then management should correct the deficiencies and produce reliable IRR measurements.

### Evaluate Objective Data

Objective data should accurately reflect the bank's condition. Management may enter data into the system manually or employ a computerized data extract program. Independent review should ensure that the system contains accurate objective data.

**Account data** should accurately describe each category or instrument, including:

- Current balances
- Contractual coupon rates and formulas
- Coupon reset dates
- Scheduled principal payments
- Scheduled interest payments
- Caps and floors
- Maturities

Review the account data for larger and more complex

account categories. For example, adjustable rate mortgages' (ARMs) account data should include rate indices, coupon formulas, periodic coupon caps and floors, lifetime caps and floors, and coupon reset dates.

Often, detailed account data resides in subsidiary systems. The deposit, commercial loan, mortgage, and investment systems usually contain account data needed for the IRR measurement system.

If management uses a data extract program, then review the program's output and verify that it transfers accurate data to the IRR measurement system. Otherwise, verify account data accuracy using the general ledger, subsidiary ledgers, and any other available information.

**Data aggregation** processes should reasonably group individual instruments into categories according to their types and cash flow characteristics. Most banks aggregate data to increase efficiency. Management should carefully consider this process and should develop an aggregate account chart that accurately represents the bank's cash flow characteristics. Aggregation varies greatly and depends upon the bank's size, complexity, and measurement system.

Review the data aggregation process and ensure that it reasonably portrays the bank's cash flow characteristics. Management should not aggregate material volumes of dissimilar instruments, including:

- Instruments with materially different coupon rates (for example, 7% and 10% fixed-rate mortgages).
- Instruments with different coupon structures (for example, fixed-rate and adjustable-rate).
- Instruments with different prepayment characteristics (for example, FNMA and GNMA mortgage-backed securities).

Management should more precisely stratify accounts whenever cash flow characteristics create material differences within a category. For example, banks with large fixed-rate mortgage and ARM volumes generally must stratify those assets more exactly.

**Base case interest rates** should accurately illustrate the current rate environment (as of the analysis date). Verify that the base case interest rates and market values were accurate. Most systems, particularly duration and simulation models, can not generate

accurate results using incorrect current market rates.

### Assess Key Assumptions

All measurement systems rely upon assumptions. Unreasonable assumptions render even the most sophisticated system's results unreliable. As a result, management must carefully develop and support all key measurement assumptions.

Review available information regarding all key assumptions, including:

- Documentation that lists and supports the measurement assumptions.
- IRR management committee and board minutes.
- Vendors' or consultants' reports.
- Independent reviews of the IRR program.

Each IRR measurement system relies upon unique assumptions. However, most systems incorporate several key assumptions.

**Projected interest rate forecasts** must be used in many systems (particularly duration and simulation models). Banks may generate internal forecasts based on supported analysis. For example, internal rate forecasts might rely on implied forward yield curves, economic analysis, or historical regressions.

Banks might also incorporate forecasts from external sources. Regardless of the source, rate forecasts should be consistent with other forecasts used throughout the bank's planning processes (for example, forecasts used to estimate loan demand).

Rate forecasts should include increasing and decreasing rate environments that provide meaningful stress scenarios and address the bank's risk exposures. Simulation system forecasts may also consider nonparallel yield curve shifts.

**Driver rate relationships** must specifically and reasonably dictate changes in all material interest rates for given changes in the driver, or primary, rates. For example, management might specify that NOW account funding costs will increase 25 basis points when the six-month Treasury bill yield increases 100 basis points.

Most systems maintain static rate relationships, but more sophisticated systems can alter the relationships for different rate environments. Review the driver rate relationships and ensure that they are supported and accurately applied.

**Reinvestment rates** determine the yields earned by projected future cash flows (after the bank receives and reinvests them), primarily in simulation models. Many systems simply assume that all future cash flows will be reinvested at one rate (for example, federal funds). More sophisticated systems use multiple reinvestment rates for cash flows from different sources. All reinvestment rates should be reasonable and consistent with other bank forecasts. Unrealistic reinvestment rates render IRR simulations meaningless.

**Nonmaturity deposit sensitivity factors** estimate volume and funding costs for those deposits. Management should determine nonmaturity deposit interest rate sensitivity and support those conclusions with documented analysis. IRRSA provides nonmaturity deposit analysis measures for examiner review.

**Prepayment forecasts** should reasonably estimate unscheduled principal cash flows from amortizing instruments. Dealer median prepayment forecasts may serve as an acceptable assumption. Should management use prepayment assumptions that differ substantially from the dealer median forecasts, those differences should be explained and supported.

**Growth estimates** should reflect the strategic goals and forecasts used in the strategic planning process. Unrealistic asset or deposit growth assumptions will invalidate the system's results.

### Review System Reports

Measurement system reports must provide clear information to management and the board. Reports should:

- Identify material risk exposures and sources.
- Report the IRR level using measures that correspond to the board's risk limits.
- Highlight deviations from the risk limits.

Carefully review all system output and ensure that the

board and management receive timely, accurate, and clear IRR measurement reports.

### Verify Measurement System Validation

Verify that management periodically evaluates and validates the measurement system's adequacy and accuracy. Determine if the system's prior forecasts reasonably estimated actual performance. Focus on evaluating:

- Procedures that compare past system results to actual results.
- Procedures that compare market value assumptions to observable market prices.
- Results from other systems that may verify measurement system results.

### Measurement System Review Conclusions

Determine if the internal measurement system produces reliable IRR results. Minor system deficiencies should not invalidate the results. However, material flaws may render the results unreliable. If the system's results can not be used as a basis for the examination's IRR assessment, then the system is not satisfactory.

## VII. IRR REVIEW REFERENCE

***This reference is not a substitute for the interest rate risk (IRR) guidance contained in the DOS Manual of Examination Policies. Rather, it is a review of conditions that may indicate significant IRR exposure. Such exposure may warrant expanded IRR examination procedures.***

## Level One Examination Procedures

### Policies and Risk Limits:

- ◆ The Board has not approved and periodically reviewed IRR policies.
- ◆ IRR policies do not address the current risk profile.
- ◆ The Board has not established prudent IRR exposure limits relative to earnings and capital.
- ◆ IRR policies do not clearly establish management's authority and responsibility.
- ◆ The Board has not reviewed and approved exceptions to IRR policies and risk limits.

## **Board and Management Controls and Reporting:**

- ◆ Management's expertise and staffing are not commensurate with the IRR profile.
- ◆ The Board has not reviewed and approved the IRR measurement system.
- ◆ IRR reports are not reviewed by the Board at least quarterly.
- ◆ IRR reports do not clearly quantify IRR levels or illustrate compliance with established risk limits.

## **Independent Review:**

- ◆ Independent review of IRR management and controls is not commensurate with the bank's size and complexity.

## **Objective Criteria:**

- ◆ The bank does not meet established objective criteria (IRRSA Cover Page).



## VII. IRR REVIEW REFERENCE - Continued

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### Level Two Examination Procedures

#### Historical Financial Analysis:

##### Earnings and Net Interest Margin

- ◆ The net interest margin demonstrates significant volatility relative to market interest rates (IRRSA p. 3).
- ◆ The net operating income to average earning assets ratio demonstrates significant volatility, that results primarily from net interest margin fluctuations (IRRSA p. 3).

##### Securities Appreciation/Depreciation

- ◆ High current or historical appreciation or depreciation levels (IRRSA p. 1).
- ◆ Significant appreciation or depreciation fluctuations relative to market interest rates (IRRSA p. 1).
- ◆ High depreciation levels are not offset by appreciation in other instruments.

##### Balance Sheet Composition

- ◆ Rapidly changing asset or funding structures (IRRSA pp. 1-2).
- ◆ High or increasing levels of instruments containing embedded options (IRRSA p. 1).

#### Internal Measurement System Results:

- ◆ The results illustrate risks different from those identified by historical financial analysis.
- ◆ The results indicate risk exposures that exceed management's established risk limits.
- ◆ The results suggest that the system contains obvious deficiencies.

#### Management's Strategic Initiatives:

- ◆ Management plans new activities that will substantially alter the bank's risk profile.

## VII. IRR REVIEW REFERENCE - Continued

*This reference is not a substitute for the interest rate risk (IRR) guidance contained in the DOS Manual of Examination Policies. Rather, it is a review of conditions that may indicate significant IRR exposure. Such exposure may warrant expanded IRR examination procedures.*

### Level Three Examination Procedures

#### *Risk Exposures*

- ◆ The bank has material repricing, basis, yield curve, option, or price risk exposure.

#### Internal Measurement System Capabilities:

- ◆ The system can not capture or reliably measure risk exposures (for example, repricing, basis, yield curve, option, and price risk).
- ◆ Management has not completed needed system updates (for vendor systems).

#### Internal Measurement System Data and Assumptions:

- ◆ Account data is inaccurately captured.
- ◆ Account data is improperly aggregated.
- ◆ Necessary data fields (for example, caps or floors) are omitted.
- ◆ Rate forecasts are unreasonable.
- ◆ Reinvestment rates are unreasonable.
- ◆ Relationships between driver rate(s) and dependent rates are unreasonable or unsupported.
- ◆ Customer account behavior assumptions are unreasonable or unsupported.

#### Internal Measurement System Results and Validation:

- ◆ Management does not verify the results' accuracy.
- ◆ Management does not compare past results to actual performance.

### Level Four Examination Procedures

- ◆ Available information indicates current or potential risk exposure that may threaten earnings viability, endanger capital, or create other safety and soundness concerns.
- ◆ Management has not committed to correcting the deficiencies identified during the examination.